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An Empirical Analysis of the Central Bank of China's Monetary Policy and the Impact of its Communications on Market Interest Rates, Liquidity and Credit

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Abstract: As one of the largest world's economies, China's economy plays an important role at regional and global levels. In this context, with the fast opening steps of the Chinese economy to international markets, the Chinese Central Bank (PBC or PBOC) has adjusted its mechanisms to the needs of local and international economies. Chinese monetary policy is designed to keep prices and economic growth stable and to ensure the country's economic development. The Chinese Central Bank has a significant influence over Chinese interest rates, interbank rates, and changes in liquidity and credit. The main goal of this research paper is to describe the role of the Chinese Central Bank in delivering Chinese monetary policy and its changes over the past few years. Our research paper is dedicated to verifying how the Chinese Central Bank's press releases are useful indicators for the future trend of market interest rates after constructing a numerical index representative of expansive or restrictive net signals contained in any of the PBC Communications examined. An empirical analysis over Chinese Monetary Policy Communications (Reports) is included in this research paper, presenting how the Central Bank of China is implementing its monetary policy in order to influence the development of its economic growth through its market interest rates, liquidity and credit movement.

Keywords: Central Bank of China - People's Bank of China (PBC, PBOC); Chinese Monetary Policy Communications (Reports); interest rates; liquidity; credit (loans).

JEL classification: E43; E47; E58; C58.

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1. INTRODUCTION

Nowadays, the Chinese economy plays an important role in international economic collaboration. At the beginning of 2020, the Chinese economy had a period of decrease in its growth, to the lowest rate of 1.6 percent. In order to keep a flexible monetary sector, it was seen as an important measure to increase liquidity and have low market rates (World Bank, 2020).

During business fluctuations and macroeconomic changes, countries use their monetary policies as a tool to keep a stable economic system. For instance, after 2020, China's Central Bank (PBC, 2020) had to adjust its monetary policy in order to support the Chinese economy which was affected by COVID-19. PBC had to consider avoiding debt and property risks. The first months of 2020 affected the Chinese economy, its labour market, social stability, and mobility around the country. The People's Bank of China planned in January 2020 to increase credit and reduce funding costs to help small firms, considered as main factors for economic and job growth. PBC also announced that it was cutting reserve requirement ratios (RRR), lowering interest rates on banks' excess reserves. The Chinese Central Bank also considered at the beginning of the year 2020 to apply liquidity policy tools to sustain economic activity, along with price-based tools, market rates, and lending rates with the loan prime rate (Yao, 2020).

Chinese Monetary Policy Communications (Reports) show that Chinese monetary policy plays an important role in creating an environment for sustained economic growth.

The main content of this paper is based on the following aspects. This research paper analyses the Monetary Policy Reports (Communications) of the PBC that represent its most important tool for implementing its monetary policy and describes the Chinese monetary policy followed by the People's Bank of China after 2015. This empirical analysis shows how the Chinese Central Bank (PBC) adjusted its policies to the country's needs and observes how PBC influenced the market interest rates and adjusted its policies to the requirements of the international banking environment.

The main body of the paper is organized as follows: Section 2 of the paper presents the role of the Central Bank of China and its monetary policy and shows the literature review concerning the interest rates. Here is also presented our research model. The evolution of financial markets in China is analysed in Section 3. This chapter also presents and evaluates the content of the Central Bank's Reports (Communications) for the last years, starting from the first quarter of 2015 until the first quarter of 2022. Different aspects of liquidity policy with effects on market interest rates are investigated in Section 4. Section 5 discusses the data, methodology and empirical strategies used in the research, presents the data and discusses the estimated results. Section 6 studies the link between Chinese Central Bank Communications and the future changes in market interest rates. Section 7 presents the connection between liquidity, PBC's Communications and changes in market interest rates and in credit (loans). Sections 8 and 9 concludes offering a general perspective concerning the results, discussions, limitations and implications of this research.

2. THE ROLE OF THE PEOPLE'S BANK OF CHINA AND ITS MONETARY POLICY AND THE LITERATURE REVIEW ON THE EFFECTS OF CHINESE CENTRAL BANK'S COMMUNICATIONS ON MARKET INTEREST RATES IN CHINA WITH THE PRESENTATION OF OUR RESEARCH MODEL

On December 1, 1948, the People's Bank of China (PBC or PBOC) was created from the fusion of Huabei Bank, Beihai Bank and Xibei Farmers' Bank. Later, it started to work for the

first time as a central bank, based on the decision of the State Council in September 1983. PBC has the following main functions: the enforcement of relevant laws; the implementation of monetary policy; the administration of circulation of Chinese currency, Renminbi (RMB); the regulation of financial markets, with the interbank lending and bond market; maintenance of financial stability; maintenance of an equilibrium for RMB exchange rate; management of state treasury; the implementation payment and settlement systems rules; the guidance against money laundering; the development and consolidation of financial statistics; the administration and development of credit information system; participation in different international financial events; coordination of financial business operations; and the implementation of other functions in conformity with the requirements of the State Council (PBC, 2018b).

Like any other central bank around the world, the Chinese Central Bank has its own particularities, reflected from an emerging economy and its challenges, and adapting to international requirements, while following its internal market interests. First, PBC cannot directly influence the level of money supply. However, similar to other countries around the world, Chinese monetary policy has several main goals. Having as its main interest economic growth, PBC adjusts its monetary policy to play an important role concerning the influence on interest rates, adjusting its policy to influence prices and keep a stable rate of inflation and financial market stability (McMahon *et al.*, 2018).

During or after periods of financial crisis, it is considered mandatory for any central bank, including PBC, to develop monetary policy communications as a strong monetary policy tool to be able to effectively contribute to the implementation of its monetary policy (Xu, 2019).

For the beginning of the pandemic period, from January 2020 to the middle of July 2020, Chinese monetary policy is summarized as not being based on a singular reaction, but on a successive series of easing actions with a gross liquidity injection of RMB 8 trillion between February and June (Funke & Tsang, 2020).

Some recent research papers showed that the communication between PBC and the private sector has increased in recent years. However, this communication is not directly perceived as a part of Chinese monetary policy, but mainly as a guide that includes methods and strategies concerning financial data that can be used. The section of communications of PBC can be found on its website under "regular and irregular communication events". The first category includes reports concerning the implementation of monetary policy and main financial information, while the second category includes press conferences and public events. The Chinese Central Bank also uses Open Market Operations (OMO) to maintain an adequate amount of liquidity during interbank operations (Liu *et al.*, 2022). In this sense, PBC repo and reverse repo agreements are used as primary instruments for OMO of PBC, replacing purchases and sales of government securities and central bank bills, used in the early and late 1990s respectively (Jones & Bowman, 2019).

There are three specific communication strategies of PBC that include a fixed testimony strategy that started in January 2013, a strategy for high-frequency senior officials' communication that suggests the future inclinations of monetary policy, and same-day communication on monetary policy or on different aspects of the Chinese and world economies (Su *et al.*, 2020).

The People's Bank of China provides the daily Bank Lending Rate. The Bank Lending Rate represents the nominal lending rate with a maturity of one year. China's Bank Lending Rate was at 4.35 % in August 2020. This Bank Lending Rate is refreshed daily and it had an average of 6 % from 1988 until July 2020, with 11,663 observations (CEIC, 2023).

In 2014, the PBC stated its Interest Rates Corridor (IRC) framework. Prior to this, PBC used Benchmark Interest Rates (BIR) to influence and control the interest rate market. Using the IRC framework allows the Central Bank to manage market interest rates for overnight interbank loans by operating standing facilities. The interest rate on excess reserves represents the lower bound and the Standing Lending Facilities (SLF) the upper bound of the IRC of China (Chang *et al.*, 2021).

The current literature covers in general different changes in the Chinese Monetary policy during the years, but there is not a clear analysis of the Reports or communications of the Chinese Central Bank. Therefore, in this research paper, the daily data and central bank communication indexes cover a six- to seven-year period, starting from 2015. The interbank rates are taken from the Shanghai Stock Exchange (SSE) and the same database, while the macroeconomic information comes mainly from PBC reports.

The articles dedicated to the impact of the Central Bank of China's press releases on the financial markets are not very numerous. In most of them the effect on market interest rates is studied (Garcia-Herrero & Girardin, 2013; Picault & Renault, 2017; Su *et al.*, 2020). However, Sun (2020) deals with the communication effect on the stock market.

They all mainly deal with market reactions in the very short term (daily responsive) generally following an event-study approach. In particular, Garcia-Herrero and Girardin (2013) and McMahon *et al.* (2018) study the effect on volatility of the communications, while the others study the effect on returns or price variations.

The result of their analyses is that central bank releases have a significant effect on the variables considered. However, Sun (2020) found that market interest rates barely respond to the qualitative MPC (Monetary Policy Committee) announcements about monetary policy stance. On the other hand, the findings from Su *et al.* (2020) indicate that the PBC's communication has a significant effect on the country's money market, but informal communication appears to be more effective than formal communication.

Only two papers explicitly addressed the problem of representing the qualitative content of Chinese Central Bank press releases with a numerical index, either because communications were represented with dummies indicating the type of press release, or because they had a clear quantitative content.

Su *et al.* (2020) constructed PBC's communication indexes consisting of those on domestic economic outlook, world economic outlook, and domestic monetary policy inclination. As they stressed, "Since the coding process is not completely objective as biases may not be ruled out, the information is coded repeatedly and independently to deal with the problem as in Fratzscher (2008). Following the procedure, the communication is analyzed repeatedly and independently up to three times."

Bennani (2019) used the financial dictionary developed by Loughran and McDonald (2011) to compute an index for the tone of PBC's communications. This approach has two advantages: researcher subjectivity is avoided; a computer program was employed to determine the frequency of single words can be employed and so it is easy to replicate the analysis. She found that PBC's communication does not have a persistent effect on stock prices, but its tone still has a positive and significant impact on stock prices even when controlling for all the monetary policy instruments implemented by the central bank.

A somewhat overlooked problem for China (apart from Sun (2020)) is the possibility of using central bank releases to predict the future trend of important variables, such as interest rates, over a not very short horizon period. This has already been the case for several years in

the case of other central banks (e.g. Gerlac, 2007; Rosa, 2009; Cour-Thimann & Jung, 2021) and this deficiency is all the more relevant given that the implicit forward rates obtained by the term-structure of interest rates in China are very poor forecasters compared to the US and Eurozone (an example is reported in the Table no. A1 of the Annexes).

Our article is therefore dedicated to verifying how the PBC press releases are useful indicators for the future trend of market interest rates after constructing a numerical index representative of expansive or restrictive net signals contained in any PBC communication examined.

In **our research model** we assumed that forecasts are made on day t and all the explanatory variables are actually known on that day. As regards the market interest rate, Shibor interbank rates and the yield on bonds issued by the Treasury were used. The indexes we constructed to measure the content of PBC's releases are different from those employed in Su *et al.* (2020) and Bennani (2019), and were mainly inspired by the "field-specific dictionary" approach of Picault and Renault (2017). They will be explicitly described in Section 4.

R_t being the generic market interest rate, the first analysis considered the ability of our generic index W_t of the PBC's releases to predict the future variation $(R_{t+N} - R_t)$ of the interest rates r, where $r_t = (R_t - PR^*_t)$ was introduced as a further variable with PR^*_t representing the PBC's benchmark interest rate (Gang, 2021).

If taking into account the Chinese rate corridor, the first choice seems to be *the average between the 7d Standing Lending Facilities (SLF) rate and the interest rate on excess reserves* (i.e. the two boundaries of the corridor). In any case, regression estimations change only marginally if other definitions of PR* are employed. Given the width of the corridor (much larger than that of the European and American central banks (see Table no. A2 and Figure no. A1 in the Annexes), the very limited movement in Chinese policy rates, and the fact that certain rates such as 1m-Shibor do not respect it, we supposed that the inclusion of $(R_t - PR^*_t)$ among the regressors is sufficient to describe the tendency towards a rebalancing of market rates without employing any particular econometric technique considering explicitly the effect of corridor boundary.

Subsequently, we added some other explanatory control variables known on day t, x_{it}, to the equation to make the forecasts more efficient and to better verify the relevance of the PBC releases:

$$(R_{t+N} - R_t) = \alpha + \beta W_t + \lambda(R_t - PR^*_t) + \gamma x_{it}$$

Our hypothesis is that $\beta>0$ (communications suggesting a restrictive monetary policy are followed by market rate increases,) $\lambda<0$ (a too high market interest sate is followed by a reduction). We suppose also that that β will generally remain significant also in equations containing control variables since they do not incorporate all the information that can be found in PBC's communications.

3. EVOLUTION OF FINANCIAL MARKETS IN CHINA AND THE CONTENT OF PBC REPORTS (COMMUNICATIONS)

Chinese financial markets follow small steps for achieving sustainable development given their large size and dynamism. According to the main literature research, the regulation of Chinese financial markets is conducted by the Central Chinese Bank that works together with the State Council and the Ministry of Finance. Therefore, the monetary policy committee of PBC exists mainly as a consultative body. It meets quarterly without announcing its meeting dates, although press releases are issued after meetings (Das & Song, 2022).

Several standards serve to maintain an effectively regulated financial market. As a regulatory organization the targets include the independence of resources and as regulatory value the legislative control of quality and transparency of regulations. These standards also include coordination mechanisms that follow international regulations; the issuing of securities and derivatives, with the quality of information available to investors, rights of consumers and investors of financial services; financial stability; and the transparency of the infrastructure, concerning the regulation of the clearing and depository services. There are also some criteria that serve to assess the effectiveness of the regulation of financial markets. These criteria include: the functional efficiency with comparative analysis of monetary policy results, operating efficiency, analysis of productivity ratios, economic efficiency with statistical analysis of the dynamics of GDP, gold reserves, budget deficit, trade balance, and social and technological efficiency (Isaeva & Leshchenko, 2019).

Several communication indexes from the Central Bank of China reports were constructed and used in the empirical analysis of this paper. The findings show that the Bank keeps in-step with the information from the reports. Its reports also continue to influence the country's monetary policy. These communications have a strong impact on the interbank Chinese money market, influencing credit growth as well.

This research paper presents how to quantify Chinese Central Bank communications. More precisely, it considers the content of the Bank's reports from 2015 to 2022, observing the role of the Central Bank for promoting economic growth, monetary policy and influencing interest rates and credit.

An important aspect of this research is the attention concerning the methodology used to derive quantitative texts from the qualitative texts found in the reports of the Chinese Central Bank.

According to the PBC report (PBC, 2015), in the **first quarter of 2015**, the Chinese economy faced substantial downward pressures from overall price inflation that had moderated and the uncertainties that had grown in terms of the changes in the RMB supply as a result of foreign-exchange purchases. Based on these aspects, the PBC used several monetary policy tools to increase the supply of liquidity, maintaining it at desirable levels. The benchmark deposit and lending rates and interest rates of repo operations were lowered to decrease market rates and to stabilize real interest rates. In order to manage aggregate credit and structural adjustments, the PBC made sure that financial institutions optimized the structure of their loans and increased credit for the agricultural sector and for small and micro enterprises (PBC Report 2015, Q1, p.19).

A very important step done by PBC in **2016** (PBC, 2016) was the implementation of Open Market Operations (OMO). From the beginning of February 2016, PBC adopted daily OMOs, so that OMOs could be conducted daily and not twice a week as previously (PBC, 2016).

The growth of repo transactions in the interbank market doubled, and the turnover of interbank borrowing increased rapidly. In terms of financing among financial institutions, the flow of funds had several characteristics. First, Chinese-funded large banks remained net fund providers and the amount of their net lending surged accordingly. In the first quarter of **2016**, net lending by Chinese-funded large banks through repos and interbank borrowing increased by 118.5 percent year on year to RMB 58.7 trillion. Second, the level of net borrowing by securities institutions increased rapidly. In fact, in this quarter, the level of net borrowing by securities institutions increased by 128.5 percent year on year to RMB 15.8 trillion. Third, the level of net lending by Chinese-funded small- and medium-sized banks declined significantly compared with the previous year. The net borrowing by Chinese-funded small- and medium-

sized banks increased by 11.1 percent year on year to RMB 11.7 trillion, showing a decline of 5.5 trillion yuan from the previous period (PBC, 2016).

In the first quarter of 2017 (PBC, 2017) liquidity in the banking sector was generally stable, with money, credit, and all-system financing aggregates growing steadily and relatively rapidly, and with lending structures continuing to improve. Interest rates recovered from their low levels and RMB exchange rates remained generally stable.

In the first quarter of **2018** (PBC, 2018a), on January 25, the policy of a targeted reduction in the requirement reserve ratio (RRR) for financial inclusion began to be fully implemented.

In the first quarter of **2019** (PBC, 2019), liquidity in the banking system was at a reasonable and adequate level, and money-market interest rates declined. In March, the monthly weighted average interest rate of interbank lending and of pledged repos posted 2.42 percent and 2.47 percent respectively, down 15 basis points and 21 basis points from December 2018. Large efforts were made to promote convergence of the benchmark deposit and lending interest rate with the money-market interest rate, strengthen the guiding role of the policy rates system, improve the interest-rate corridor mechanism, enhance the PBC's capacity to manage interest rates, and improve the transmission of central-bank policy rates to market rates, especially lending rates.

During the pandemic period of the first quarter of **2020** (PBC, 2020), the RRR and excess reserve ratio for financial institutions were cut to support development of the real economy. First, on January 6, 2020, PBC lowered the RRR for financial institutions by 0.5 percentage points, excluding finance companies, financial leasing companies and auto finance companies, releasing over RMB 800 billion of long-term funds. Second, on March 16, the PBC implemented a targeted RRR cut for inclusive finance. Based on the assessment of the issuance of loans for inclusive finance in 2019, it granted a preferential RRR cut of 0.5–1.5 percentage points to eligible institutions, and thereby released approximately RMB 400 billion in net long-term funds. On January 15, the PBC conducted Medium-term Lending Facility (MLF) operations in the amount of RMB 300 billion, with an interest rate of 3.25 percent.

In the **first quarter of 2021** (PBC, 2021), weighted average interest rates on loans remained at low levels. In 2021, the PBC continued to release the potential of the Loan Prime Rate (LPR) in optimizing resource allocations.

In a market-oriented approach, financial institutions are encouraged to allocate more financial resources to Medium Sized Banks (MSB) to improve the competitiveness of MSBs in obtaining loans, and to cut profits in favour of the real economy.

In the **last quarter of 2021** (PBC, 2021), the main goals of the PBC were to conduct monetary policy operations in a flexible manner, adjust the required reserves ratios for financial institutions, leverage the structural guidance role of credit policies, and continue market-based interest rate reform. In this quarter, PBC maintained a flexible monetary policy, coordinated cross-year policies and adjusted the credit aggregate and structure. The main goal of the PBC was to support weak links and key areas through lowering the required reserve ratio (RRR) and strengthening the use of structural monetary policy instruments. Together with the reform of LPR, PBC strengthened the stability of aggregate credit growth and decreased the financial costs for enterprises, helping to create a favourable monetary and financial environment (PBC, 2021).

In the **first quarter of 2022**, PBC tried to promote a stable monetary policy to maintain adequate liquidity and to reduce the RRR for financial institutions in order to sustain the real economy (PBC, 2022).

4. INTERACTIONS BETWEEN CHINESE MONETARY POLICY OPERATIONS, LIQUIDITY AND MARKET INTEREST RATES

The market interest rates analyzed in this paper are the interbank interest rate Shibor, with maturity from overnight to 1 year (China Foreign Exchange Trade System, 2023) , and the Treasury interest rates (PBC, 2023) with maturity from 3 months to 30 years.

Their main statistics, divided by type and maturities, are shown in Table no. 1:

Table no. 1 – Chinese market interest Rates: Main statistics

	Shibor								*Treasury*							
Maturity	**ON**	**1W**	**2W**	**1M**	**3M**	**6M**	**9M**	**1Y**	**3M**	**6M**	**1Y**	**3Y**	**5Y**	**7Y**	**10Y**	**30Y**
Mean	2.05	2.43	2.70	2.90	3.05	3.14	3.21	3.28	2.30	2.42	2.53	2.82	2.98	3.15	3.16	3.71
Median	2.04	2.38	2.64	2.72	2.86	2.95	3.00	3.09	2.21	2.31	2.43	2.79	2.97	3.13	3.14	3.73
Maximum	3.46	4.77	5.67	5.36	5.13	4.89	4.77	4.79	4.02	4.01	3.80	3.81	3.94	4.03	3.99	4.38
Minimum	0.44	1.38	1.25	1.30	1.39	1.48	1.57	1.67	0.84	0.97	1.12	1.41	1.79	2.33	2.48	3.07
Std. Dev.	0.55	0.49	0.72	0.83	0.87	0.83	0.78	0.76	0.54	0.53	0.51	0.42	0.39	0.35	0.35	0.33
Obs.	1984	1984	1984	1984	1984	1984	1984	1984	2007	2007	2007	2007	2007	2007	2007	2007

Note: Sample: 1/01/2015 31/03/2023; Days with available data: Shibor = 92.19%, Treasury = 93.26%

The average and median values of interest rates are, as usual, higher as the maturity increases, and, instead, their standard deviation tends to be smaller the maturity increases. At the same maturity, however, treasury yields are lower than those of interbank rates.

Correlation among their moving average monthly changes are reported in Table no. 2. They are all positive (interest rates tend to move in the same direction) and correlation is stronger if maturities are similar.

Table no. 2 – Correlation among monthly market variations of Chinese market interest rates

		Shibor								*Treasury*							
		ON	**1W**	**2W**	**1M**	**3M**	**6M**	**9M**	**1Y**	**3M**	**6M**	**1Y**	**3Y**	**5Y**	**7Y**	**10Y**	**30Y**
Shibor	**ON**	1.00	0.65	0.49	0.30	0.26	0.21	0.19	0.19	0.30	0.25	0.23	0.24	0.18	0.12	0.10	0.09
	1W	0.65	1.00	0.76	0.57	0.43	0.29	0.26	0.26	0.32	0.27	0.25	0.25	0.17	0.09	0.12	0.05
	2W	0.49	0.76	1.00	0.69	0.57	0.47	0.44	0.43	0.46	0.41	0.37	0.33	0.26	0.17	0.17	0.11
	1M	0.30	0.57	0.69	1.00	0.85	0.73	0.64	0.64	0.61	0.54	0.49	0.42	0.30	0.19	0.20	0.16
	3M	0.26	0.43	0.57	0.85	1.00	0.93	0.87	0.86	0.70	0.65	0.61	0.51	0.41	0.28	0.27	0.26
	6M	0.21	0.29	0.47	0.73	0.93	1.00	0.97	0.96	0.66	0.66	0.65	0.55	0.44	0.29	0.25	0.29
	9M	0.19	0.26	0.44	0.64	0.87	0.97	1.00	0.99	0.62	0.66	0.67	0.57	0.45	0.29	0.25	0.30
	1Y	0.19	0.26	0.43	0.64	0.86	0.96	0.99	1.00	0.63	0.67	0.68	0.57	0.45	0.30	0.25	0.31
Treasury	**3M**	0.30	0.32	0.46	0.61	0.70	0.66	0.62	0.63	1.00	0.89	0.79	0.65	0.52	0.42	0.34	0.33
	6M	0.25	0.27	0.41	0.54	0.65	0.66	0.66	0.67	0.89	1.00	0.91	0.75	0.63	0.49	0.39	0.43
	1Y	0.23	0.25	0.37	0.49	0.61	0.65	0.67	0.68	0.79	0.91	1.00	0.77	0.67	0.54	0.44	0.49
	3Y	0.24	0.25	0.33	0.42	0.51	0.55	0.57	0.57	0.65	0.75	0.77	1.00	0.92	0.81	0.71	0.67
	5Y	0.18	0.17	0.26	0.30	0.41	0.44	0.45	0.45	0.52	0.63	0.67	0.92	1.00	0.91	0.83	0.71
	7Y	0.12	0.09	0.17	0.19	0.28	0.29	0.29	0.30	0.42	0.49	0.54	0.81	0.91	1.00	0.95	0.80
	10Y	0.10	0.12	0.17	0.20	0.27	0.25	0.25	0.25	0.34	0.39	0.44	0.71	0.83	0.95	1.00	0.82
	30Y	0.09	0.05	0.11	0.16	0.26	0.29	0.30	0.31	0.33	0.43	0.49	0.67	0.71	0.80	0.82	1.00

The graphs of the most significant rates are shown in Figure no. 1.

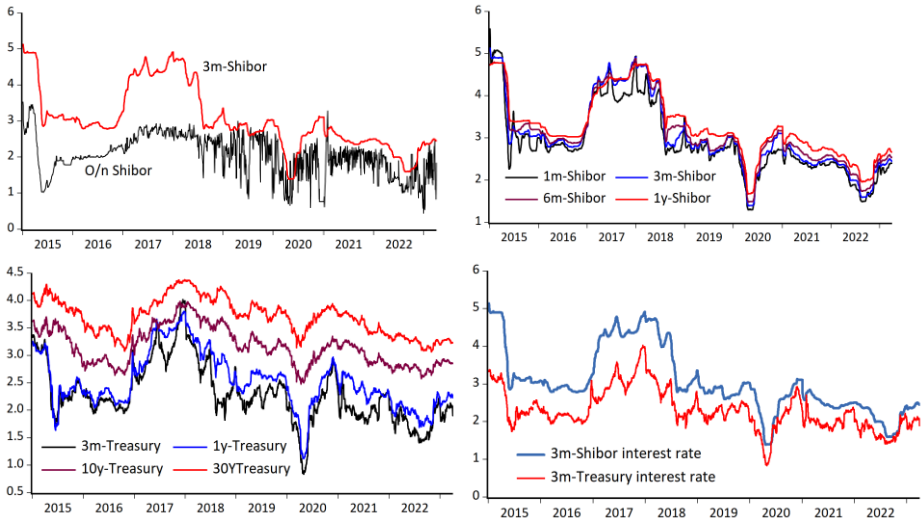


Figure no. 1 – Chinese market interest rate: some examples

The publication of news items released by PBC is available on different web pages. In particular, the source of information utilized in this analysis is retrieved from PBC's Reports published on http://www.pbc.gov.cn/en/.

The total number of news items per day released on this site from 2016 to March 2022 is represented on the left part of the first row of Figure no. 1, corresponding to their double one-month moving average. For clarity, the figure also contains its "Least Squares with 1 Break" estimation. An increase in the number of news items started in the second half of 2019.

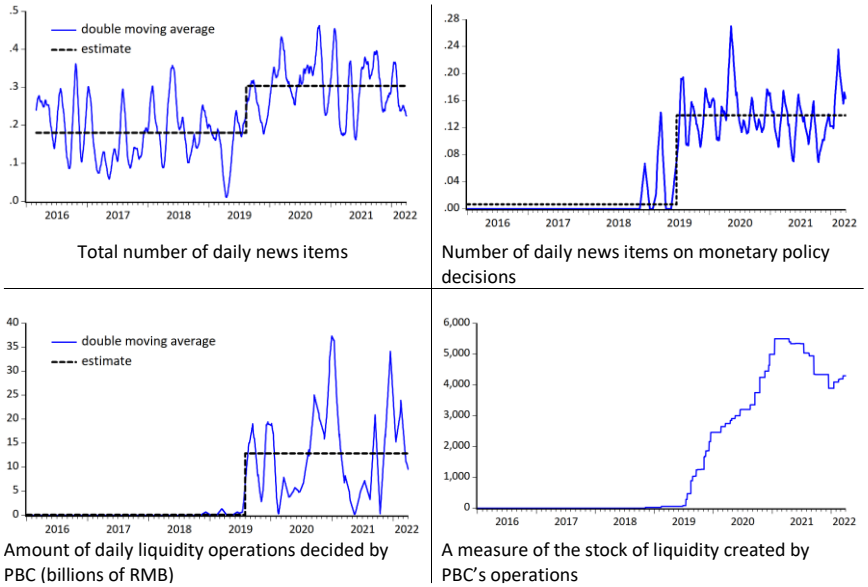


Figure no. 2 –News items provided by PBC

The news items of PBC's monetary decisions (i.e. news involving interest rates and/or liquidity), started in 2018 and reached a steady horizontal trend in the second half of 2019 (Figure no. 2). The corresponding increase in total overall news items is probably linked to the increase in monetary policy interventions.

Table no. 3 presents the list of monetary policy news items divided by type of operations.

Table no. 3 – Types of operations, maturities and amount

Operation	Maturity								
	Not indicated	Over night	7d	1m	3m	5m	6m	1y	5y
Medium-term Lending Facility (MLF)								AR 35	
Standing Lending Facility (SLF)	A 2	R 3	R 3	R 2					
Loan Prime Rate (LPPR)								R 31	R 31
Central Bank Bills Swap (CBS					AR 30			AR 2	
Central bank bills					AR 3			A 3, R 2	
Central bank bills in Hong Kong				AR 1	AR 12		AR 11	AR 12	
Central bank lending for the rural sector and small businesses	A 5, R 4				R 1	R 1		R 1	
Targeted Medium-term Lending Facility (TMLF)	A 6								

Note: A = communication on operation amount, R = communication on interest rates; the number indicate how many times communications are given

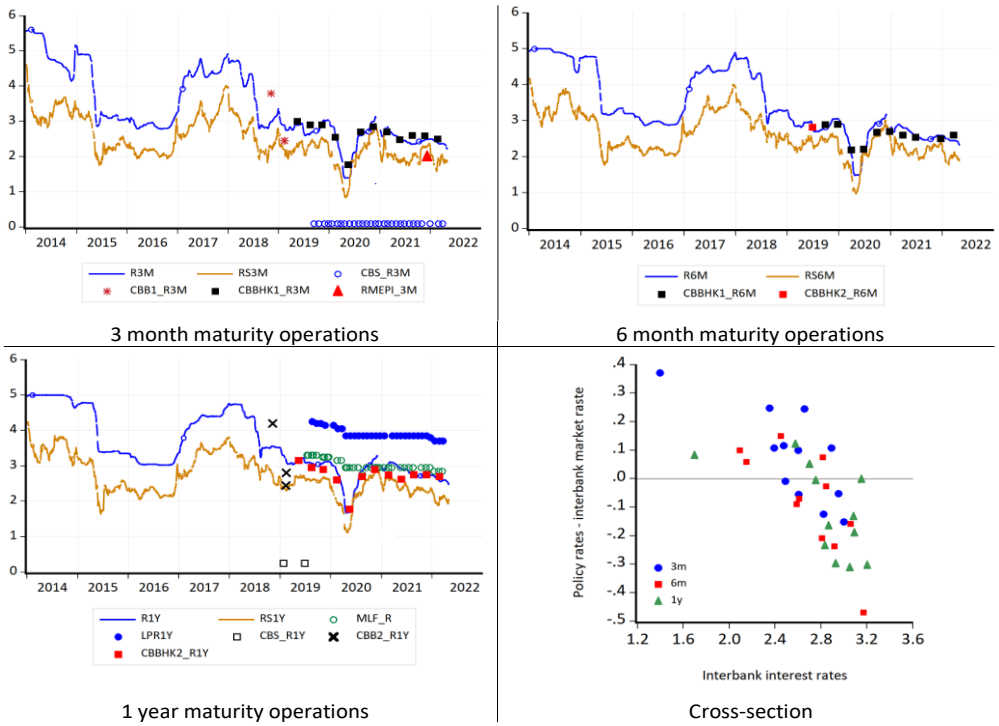


Figure no. 3 – PBC's and market interest rates

The level of policy interest rates decided by PBC is usually mostly independent from the actual levels of market interest rates of the same maturity (both interbank and treasury returns). Only in the case of the Central Bank Bills in Hong Kong operations (CBBHK1 and CBBHK2), PBC interest rates values are consistent with their correspondent market returns of the same maturity (Figure no. 3).

In case of maturities of 3-months, 6-months and 1 year, we examined the econometric relationship between policy and market interest rates. The econometric tool employed was an Ls-pool estimator, where the independent variables are the PBC's interest rates of different maturities; the explanatory variables are the corresponding interbank interest rates, the treasury interest rates, and the past value of the policy rates: it turned out that the "null hypothesis" of coefficients of both treasury rates and previous values of policy rates equal to zero cannot be rejected at the 35% and 70% level of probability respectively. The hypothesis that the coefficients between policy rates PRh,t and interbank rates Rh,t-1 are the same for any maturity that is accepted at 19% of probability. By taking into account all these results, the estimated equation becomes the following (where h is the maturity: 3, 6 months and 1 year):

$$PR_{h,t} = \underset{(0.149)}{0.757^{***}} + \underset{(0.055)}{0.704^{***}}\, R_{h,t-1} \qquad \text{adjR2=0.841}, \quad \text{Total obs.= 32}$$

where: *** = significant at 1% of probability, SE coefficients are in brackets

The coefficient of the interbank interest rate is 0.704, significantly less than 1. Also, as can be seen in the last part of Figure no. 2, the spread between policy and market interest rates is therefore smaller when the market rate is higher. By considering that markets' interest rates are statistically "persistent" and that the old policy rate does not influence the new one, it is apparent that the causality between the two variables is interbank returns influence policy rates.

An interesting question here is whether market rates on t+j are influenced by the level on day t of new policy rates. To investigate this possibility we estimated two possible equations:

$$(R_{h,t+j} - R_{h,t-1}) = \alpha+\beta(PR_{h,t} - R_{h,t-1}) \text{ and } (R_{h,t+j} - R_{h,t-1}) = \alpha+\beta\varepsilon_{h,t},$$

where $\varepsilon_{h,t}$ are the residuals of the equation above, i.e. a proxy for the market surprise.

In no case, however, did we find a stable and significant $\beta > 0$ coefficient, even when we took different values for j. The result is, therefore, that market rates influence policy rates, but policy rates do not influence market rates (see also Figure no. 4).

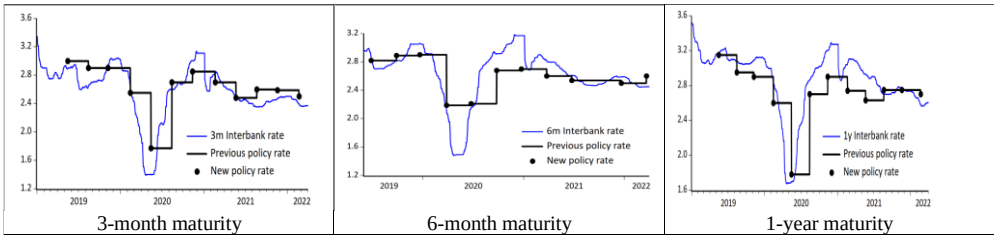


Figure no. 4 – Interbank rates and return on Central bank bills in Hong Kong

In Figure no. 5 is reported the Chinese interest rate corridor and the most important policy rates: 7-day reverse repo (OMO); Standing lending facility (SLF with maturities: O/N, 7 days, 1 month); Medium-term lending (Gang, 2021).

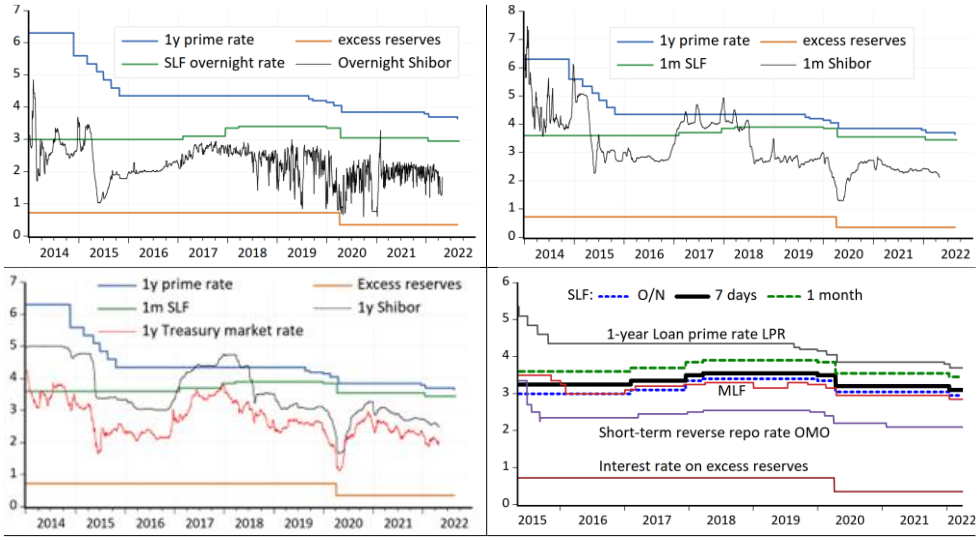


Figure no. 5 – Interest rate corridor, prime rate and market interest rates

Another important piece of information given in most monetary policy news items is the amount (in billions of RMB), and the term (i.e., the maturity) of each operation, also corresponding to liquidity creation. A double 30 day moving average of the daily amount supplied by PBC is reported in the previous Figure no. 1, where a jump in the amount in 2019 is apparent. On the right of this figure there is a daily measure of the stock of total liquidity which we obtained under the naïve hypothesis that liquidity is created on the announcement day and lasts according to the terms indicated by the Bank itself. Only operations whose maturity have been clearly indicated by PBC were considered (and some irregularities of the variable were eliminated).

It must be stressed that we calculated two different measures of liquidity stock. The former includes all operations (liquidity1), while the second was limited to the stock of "Central bank bills in Hong Kong" (liquidity2): the reason is that in the continuation of this research paper we found that both definitions might be useful.

5. PBC'S COMMUNICATIONS (REPORTS) ON ECONOMIC BEHAVIOURS AND CLASSIFICATION OF WORDS- DATA AND METHODOLOGY

The Central Bank's Communications (Reports) taken into account in this analysis correspond to the section "Executive Summary" of the China Monetary Policy Report, Monetary Policy Analysis Group of the People's Bank of China (PBC). These communications are quarterly, and the dates we associated to them are the days of their publication.

For the transformation of their content into a numerical index we followed the "field-specific dictionary" suggested by Picault and Renault (2017) with some simplification of ours (we decided which is the topic of any sentence instead of assigning different probabilities to different topics).

The statements we considered consist in couple made by an economic variable (e.g., "economic growth") and its qualifier (e.g. "small increment"). We assigned to the union between a variable and its qualifier a score from -1 (if a dovish, i.e. expansionary, monetary policy should be appropriate) to +1 (if a hawkish, i.e. restrictive, monetary policy should be appropriate). A value of zero corresponds to a neutral statement (e.g. "consumer prices" AND "stable"). In some cases, we attributed a score of just -0.5 or 0.5. (e.g. "inflation" AND "a small increase"). Our entire classification is available on request.

We divided the PBC's economic statements into the following categories:

Y = real sector (in particular: GDP growth and employment)

P = price stability (especially inflation and wages)

M = monetary, credit, and financial aggregates in general

R = interest rates (in particular: market interest rates and cost of credit)

L = liquidity and reserve requirements

E = exchange rate and trade balance

W = world economy

Their relevance, measured by the % of the total number of statements concerning each of them, is shown in Figure no. 6. The period considered goes from the first quarter of 2015 to 2022. The most numerous statements concern the behavior of the real sector (Y), while just a few statements concern price stability (P).

For each communication we assigned a score to the various topics given by the average of the scores (-1, -0.5, 0, 0.5, 1) of their individual statements. The higher (or lower) the value, the more likely a future restrictive (or expansionary) monetary policy is expected.

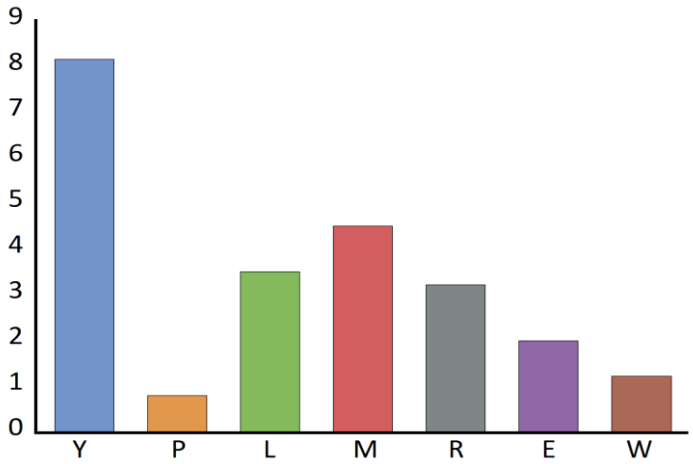


Figure no. 6 – Official communications statements: mean number of quotations of any topic we considered

Note: Period: 2015:I-2022:III; Y= real sector; P= inflation; L= liquidity and reserve requirements; M= money, credit and financial assets; R= interest rates; E= exchange rate (dollar) and trade balance; W= world economy

The statistics of scores and the correspondent number of statements considered in any communications divided by their main economic topics are shown in Table no. 4l.

Table no. 4 – Statistics of the various communications divided by arguments

Numbers:	**Y**	**P**	**L**	**M**	**R**	**E**	**W**
Mean	8.13	0.77	3.48	4.48	3.19	1.97	1.19
Median	7.00	1.00	3.00	4.00	3.00	2.00	1.00
Maximum	14	4	10	13	7	5	6
Minimum	1	0	1	1	1	0	0
Total	**345**	**21**	**138**	**302**	**147**	**39**	**61**
Scores:							
Mean	0.16	0.18	0.38	0.53	0.51	-0.13	-0.36
Median	0.13	0.00	0.42	0.50	0.57	0.00	0.00
Maximum	0.83	1.00	0.80	1.00	1.00	0.25	1.00
Minimum	-0.71	-1.00	0.00	0.00	-0.50	-0.75	-1.00
Std. Dev.	0.40	0.36	0.28	0.27	0.43	0.20	0.52

Note: Period: 2015:I-2022:III

The correlations between the scores of the various economic arguments are shown in Table no. 5.

Table no. 5 – Correlations between scores of various economic arguments

	Y	**P**	**L**	**M**	**R**	**E**	**W**
Y	1.00	0.17	-0.27	0.69	-0.48	-0.51	0.42
P	0.17	1.00	0.23	-0.14	0.16	-0.03	-0.04
L	-0.27	0.23	1.00	-0.19	0.24	0.25	-0.34
M	0.69	-0.14	-0.19	1.00	-0.50	-0.47	0.21
R	-0.48	0.16	0.24	-0.50	1.00	0.19	-0.20
E	-0.51	-0.03	0.25	-0.47	0.19	1.00	-0.27
W	0.42	-0.04	-0.34	0.21	-0.20	-0.27	1.00

Note: Period: 2015:I-2022:III

In order to determine the best way of employing our scores of the various topics of official communications in our regressions, we first established the period of forecasting the future interest rate variations corresponding to the best adaptation in terms of adjusted R2. Since the Shibor of 1 and 3 month matur-ities are among the most important interest rates, we considered just these interest rates at this stage of our analysis. Unfortunately, various data are missing, especially in early years, and, to reduce the number of missing data, we substituted a missing datum on day t of a generic R_t with its most recent available datum R_{t-h}.

However, a missing interest rate R_{t+1} on the first day after the communication day t of the central bank was substituted by the near future available R_{t+h}.

This procedure assures that the market interest rates of the first day after the communication employed can incorporate the most recent information given by the central bank.

The estimated equations are of the type:

$$(R_{t+1+\text{ h month}} - R_{t+1}) = \beta_0 + \beta_0 r_{t+1} + \beta_0 \text{Word}_t$$

where t is the day of the communications,

- $r_{t+1} = R_{t+1} - PR^*$ (the average between the 7d Standing Lending Facilities (SLF) rate and the interest rate on excess reserves + excess reserve interest rate) /2

- (i.e. is, R_{t+1} minus the central interest rate corridor – see chapter 1), and

- $Word_t$ is the weighted average of the scores of the various topics we considered on a given day t, where the weights are the number of scores of any single topic we found.

The main result is reported in Table no. 6.

Table no. 6 – Adjusted R2

Variations: h months	Method ii to measure R_t 1m-Shibor	3m-Shibor
1	-0.0642	-0.0789
2	0.2047	0.0527
3	0.1036	0.0663
4	0.0873	0.1052
5	0.3101	0.2263
6	0.2788	0.2283
7	0.2987	0.2295
8	0.4871	0.4292
9	0.4721	0.4229
10	0.3386	0.3815
11	0.4553	0.4080
12	0.3994	0.4066

Note: 1/01/2015-31/03/2023

From this table, it appears that the variation giving better adaptation corresponds to about three quarters.

After that, we verified what happens to the adjusted R^2 of any regression when eliminating the score of a single topic from the weighted average. By considered only the case of future interest rate variation of 9 months, it turned out that it was better to include the topic R separately and not in the weighted average and, perhaps, also the topic E.

However, results reported in Table no. 7 suggest that the best solution was considering the weighted average of all topics without R, and considering R as a further independent variable.

Table no. 7 – Adjusted R2 with future 9-month changes of Shibor interest rates

	1m-Shibor	3m-Shibor
Weighted average of (Y, P, L, M, R, E, W)	0.4651	0.4178
Weighted average of (Y, P, L, M, E, W) and R included separately	0.5348	0.4932
Weighted average of (Y, P, L, M, W) and of (R, E)	0.4648	0.4066
Weighted average of (Y, P, L, M, W) and R, E included separately	0.4753	0.4231

We have, therefore, accepted the hypothesis that the best way to summarize the content of the PBC's documents is to use two variables:

* *Word1*: the weighted average of the scores of Y, P, L, M, E, W;

* *Word2:* the score of the topic R.

6. PBC'S COMMUNICATIONS AND CHANGES IN MARKET INTEREST RATES

At this point we verified if our scores of PBC's reports (communications), Word1 and Word2, are useful or not in predicting the future variations of Chinese market interest rates (the Shibor interbank rate, and the yield on government bonds (Treasury interest rates)).

If compared at the international level, it should be noted that the effects of these communications on market rates are different when comparing the European Central Bank (ECB), the Fed and the Central Bank of China (PBC). In the case of the first two banks, there is an immediate reaction to official communications as well as being able to use the communication as indicators of future movements in market rates. This immediate and strong reaction cannot be found in the case of the PBC (see Figure no. A2 in Annexes on the volatility of market rates in the days before and after the meetings). The reason could be that the first two banks in their communications also provide information on the new official rates and, moreover, the information released in their communication often represents a sort of "novelty" for the financial operator, while in the PBC's case, its communications seem to be more a clarification of the decisions of the central bank than a "novelty".

The possibility of our scores of the official PBC's communications to predict the future variations of market rates (divided along the different maturities of Shibor and Treasury) was carried out by estimating their change ($R_{t+M(months)} - R_{t+1}$) in the M months following the day t of the publication of the communications themselves. The econometric method employed was a *Pooled Least Squares.*

Specifically, we have estimated the following model:

$$(R_{t+M(months)} - R_{t+1}) = \beta_0 + \beta_1 r_{t+1} + \beta_2 Word1_t + \beta_3 Word2_t$$

where r_{t+1},= R-PR* is defined in chapter 1.

$Word1_t$ and $Word2_t$ have been defined in the previous section and t is the days of PBC's communications).

The interest rate is taken on day t+1, i.e. the first day after any communication.

In pool estimator, fixed effect has been included since the redundancy test rejected the hypothesis of their redundancy.

Table no. 8 – Redundant Fixed Effects Testing

Redundant Fixed Effects Testing			
Test cross-section fixed effects			
Effects Test	**Statistic**	**d.f.**	**Prob.**
Cross-section F	2.232	(15,368)	0.0053
Cross-section Chi-square	37.617	15	0.0010

A 9-month variation was selected in this estimation: the coefficients β_1 should be negative, while β_2 and β_3 are expected to be positive and significant. Results are reported in Table no. 9.

Table no. 9 – Future 9-month changes in spot interest rates (R_{t+9m} - R_{t+1}) with different maturities and PBC's communications

Dependent variables	Regressors						
	const						
	0.509***	(0.179)					
Shibor	**r_{t+1}**		**Word1$_t$**		**Word2$_t$**		**Fixed Effects**
ON	-1.041***	(0.196)	0.850***	(0.031)	0.146***	(0.056)	-0.632
1W	-1.018***	(0.376)	0.776***	(0.031)	0.247***	(0.058)	-0.408
2W	-0.997***	(0.211)	1.248***	(0.083)	0.422***	(0.097)	-0.823
1M	-0.906***	(0.164)	1.070***	(0.115)	0.586***	(0.059)	-0.790
3M	-0.990***	(0.125)	1.481***	(0.077)	0.658***	(0.045)	-0.683
6M	-1.039***	(0.108)	1.497***	(0.059)	0.578***	(0.035)	-0.528
9M	-1.059***	(0.111)	1.482***	(0.041)	0.522***	(0.040)	-0.398
1Y	-1.053***	(0.116)	1.468***	(0.040)	0.512***	(0.040)	-0.326
Treasury	**r_{t+1}**		**Word1$_t$**		**Word2$_t$**		**Fixed Effects**
3M	-1.037***	(0.184)	0.860***	(0.030)	0.288***	(0.072)	-0.458
6M	-1.057***	(0.150)	1.013***	(0.020)	0.256***	(0.067)	-0.423
1Y	-1.099***	(0.175)	0.974***	(0.021)	0.207**	(0.089)	-0.246
3Y	-1.260***	(0.349)	0.944***	(0.033)	0.077	(0.147)	0.276
5Y	-1.464**	(0.617)	0.923***	(0.004)	-0.051	(0.268)	0.903
7Y	-1.459*	(0.756)	0.823***	(0.052)	-0.030	(0.272)	1.167
10Y	-1.497*	(0.854)	0.806***	(0.050)	0.003	(0.268)	1.216
30Y	-1.502	(0.975)	0.468	(0.372)	-0.061	(0.292)	2.152
Adjusted R2	0.490						
30Y	-0.092	(0.132)	1.275***	(0.427)	0.460	(0.190)	

Method: Pooled Least Squares with fixed effects; Period SUR (PCSE) standard errors & covariance (d.f. corrected); Sample (adjusted): 8/05/2015 - 9/05/2022; Included observations: 29 after adjustments; Cross-sections included: 16; Total pool (balanced) observations: 464; Adjusted R-squared=0.471; Prob(F-statistic)=0.000; */**/*** = significant at 10%, 5%, 1% of probability respectively.

Word1 is almost always significant at 1% of probability, and the same for Word2. However, Word1 is not significant for the Treasury rate with maturity of 30 year. Word2 is not significant for maturities longer than 1 year (not surprising since Word2 represents mainly the opinion that PBC gives on present interest rates). It is apparent, therefore, that in China, like in other countries, Central Bank communications are a relevant information source for forecasting future market interest rate movements. The coefficient of Word1 is, however, greater than Word2.

As expected, the coefficient of r_{t+1} is negative: if the present interest rate is two high, it tends to be reduced in the future.

Figure no. 7 reports the Adjusted R2 of all estimations similar to the one of table 9, but estimated for future interest variations from 1 to 15 months. The interest considered is the 1-month Shibor, an important interbank interest rate, Best estimations employing Word1and Word2 are obtained for variations of 9 to15 months, and this explains why our attention was devoted to 9 months.

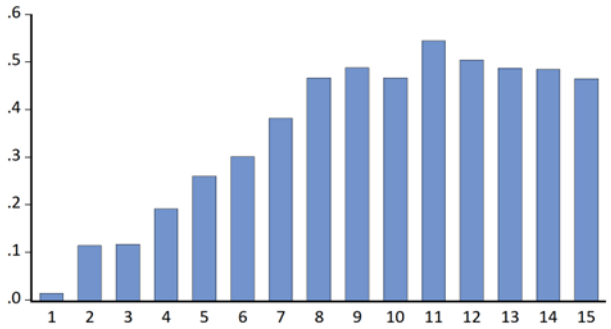


Figure no. 7 – Future changes in spot 1-month Shibor interest rate and PBC's communications: The correspondent Adjusted R2

In Figure no. 8, graphs of 1- and 3-month Shibor and 10y Treasury rates actual and forecasted rate changes are reported. Only days of PBC's reports are considered. No outliers seem to emerge. The same is true for the remaining maturities (non presented in this figure for reason of space). Also estimated coefficients seem fairly stable (see Figure no. A3 and no. A4 of the Annexes).

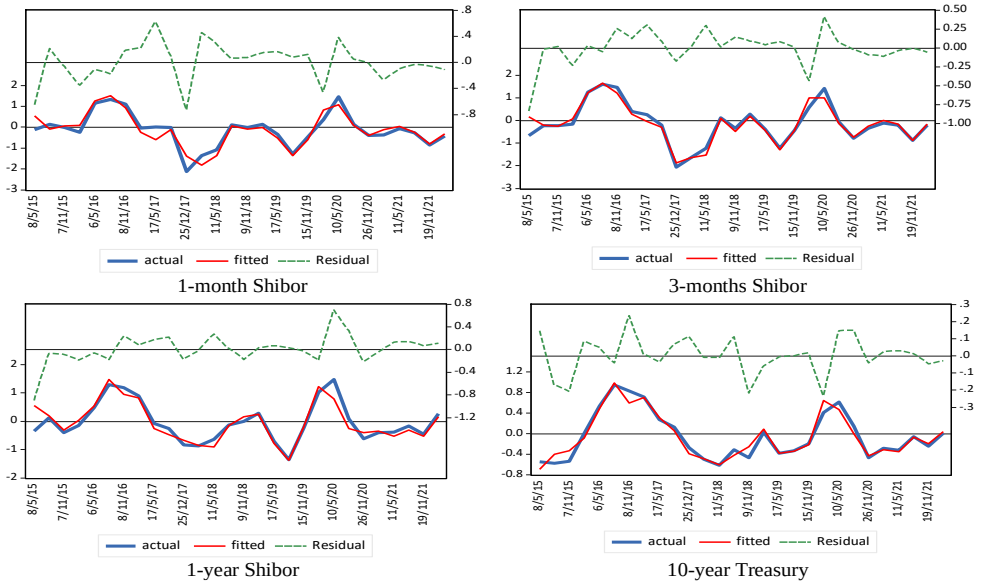


Figure no. 8 – Actual, expected value and residuals of 9 month changes in 1m, 3m, 1y Shibor and 10y Treasury rates

The impulses of Word1 and Word2 on 1- and 3-month Shibor and 10-year Treasury future interest rate variations are reported in Figure no. 9, along with their correspondent 2SE bands. The content of Figure no. 9 refers to the impulse of a unit increase in both explanatory variables. The local impulse estimator of Jordà (2005) has been employed.

Also, in Figure no. 9 it turns out that Word1 impulses are greater than those of Word2, and the maximum effect is achieved after about 9-10 months - Method: local impulse, Jordà (2005).

PBC's communications remain relevant in forecasting future market interest rate changes even when the available values of some important macroeconomic variables are added to the explanatory variables (see Table no. 11).

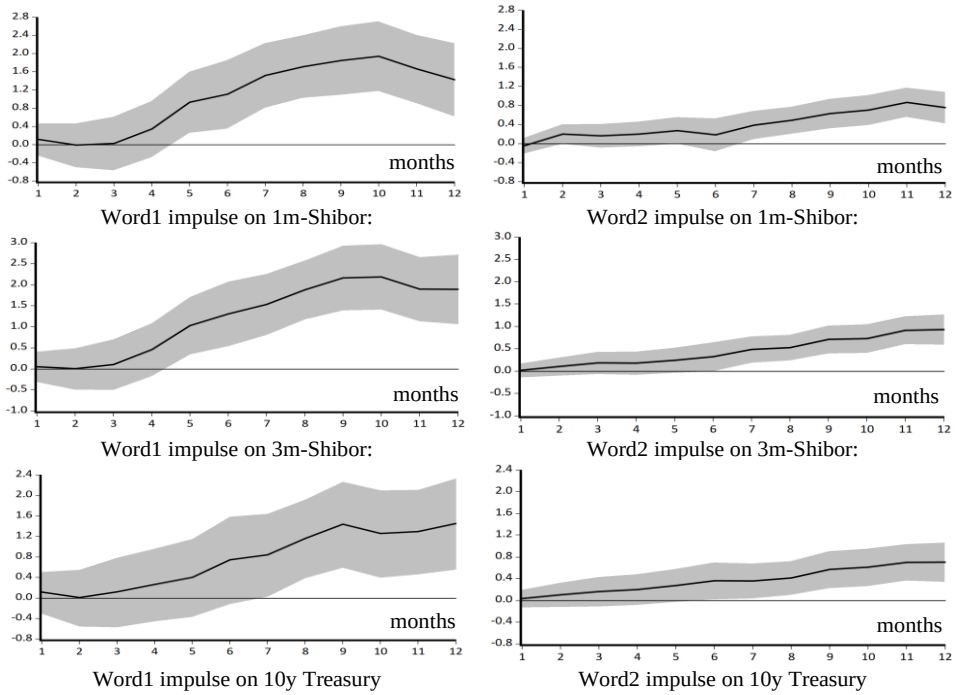


Figure no. 9 – Cumulative impulse of Word1 and Word 2 on Shibor

In order to check the robustness of our results about Word1 and Word2, we included in our regression a set of control variables (Table no. 10). They correspond to variables entering a central bank reaction function of indicating an increase in the demand or the financial assets we considered. Only values of variables known on day t+1 have been considered. This time in pool estimation fixed effects were found redundant and not used (Redundant Fixed Effects Tests: Cross-section F prob.=0.8665; Cross-section Chi-square prob=0.7207).

As we expected, inflation, annual dollar appreciation, leading indicator, M1 growth, and the ratio LOAN/GDP are positively related to future market interest rate changes, but the explanatory power of Word1 and Word2 still remains relevant.

It was also observed that the predictive power of implicit forward rates on future interest rates is very poor in China: correlations between implicit forward rates and future Shibor rate variations are insignificant at 5%, both under the one- and two-tail test (Table no. A4 of the Annexes).

Table 10 – Future 9-month changes in spot Shibor and Treasury interest rate (Rt+9m - Rt+1), PBC's communications and control variables

Dependent variables	Regressors					
	const		$ annual appreciation (log)		$INFL_{t-1month}$	
	-18.979***(2.931)		4.495***(0.556)		0.155***(0.019)	
	$(LOAN/GDP)_{t-1quarter}$		$Leading\_Indicator_{t-1nonth}$		$GM1_{t-1month}$	
	0.011***(0.003)		0.157***(0.032)		0.035***(0.004)	
Shibor	r_{t+1}		$Word1_t$		$Word2_t$	
ON	-1.041***	(0.117)	1.152***	(0.128)	1.525***	(0.187)
1W	-0.213	(0.169)	0.809***	(0.174)	1.487***	(0.227)
2W	-0.564***	(0.132)	1.116***	(0.161)	1.479***	(0.244)
1M	-0.454***	(0.173)	1.014***	(0.267)	1.266***	(0.336)
3M	-0.439***	(0.144)	1.301***	(0.299)	0.978***	(0.321)
6M	-0.408***	(0.149)	1.317***	(0.326)	0.662***	(0.317)
9M	-0.396***	(0.142)	1.425***	(0.320)	0.480	(0.340)
1Y	-0.378***	(0.143)	1.424***	(0.336)	0.561**	(0.274)
Treasury	r_{t+1}		$Word1_t$		$Word2_t$	
3M	-0.705***	(0.158)	0.446***	(0.039)	0.633***	(0.041)
6M	-0.661***	(0.165)	0.343***	(0.054)	0.649***	(0.041)
1Y	-0.584***	(0.156)	0.417***	(0.041)	0.661***	(0.041)
3Y	-0.337**	(0.159)	0.411***	(0.043)	0.591***	(0.077)
5Y	-0.161	(0.123)	0.444***	(0.055)	0.514***	(0.083)
7Y	-0.049	(0.110)	0.426***	(0.069)	0.404***	(0.092)
10Y	0.012	(0.119)	0.432***	(0.074)	0.322***	(0.102)
30Y	0.019	(0.073)	0.436***	(0.081)	0.267***	(0.097)
Adjusted R2	0.620					

Method: Pooled Least Squares; Period SUR (PCSE) standard errors & covariance (d.f. corrected); Sample (adjusted): 8/05/2015 - 11/02/2022; Included observations: 20 after adjustments; Cross-sections included: 16; Total pool (unbalanced) observations=320; */**/*** = significant at 10%, 5%, 1% of probability respectively; parameter SE in brackets.

For instance, if we estimate the mean or future 1m-Shibor rate from t+6month and t+12 month minus its value on day t+1 after PBC's official communications, it turns out that only Word1 and Word2 are significant and with the correct signs, while the sign of the implicit forward present rate ($12\times R12m_{t+1day} - 6\times R6m_{t+1day})/6 - R1m_{t+1day}$) is wrong (negative instead of positive) (Table no. A4 of the Annexes).

7. LIQUIDITY, CONTROL VARIABLES, PBC'S COMMUNICATIONS AND CHANGES IN MARKET INTEREST RATES AND CREDIT (LOANS)

Since 2019, the Chinese Central Bank has introduced many operations to regulate liquidity (see Section 3 of this paper) and these operations have influenced the movement in market interest rates, along with the information released by PBC in its official communications.

In Table no. 11, in the previous pool system we added the stock of liquidity.

We considered both alternative definitions of liquidity (Liquidity1 and Liquidity2) introduced in Section 3 of this paper, but the best result corresponds to Liquidity2. Also in this estimation fixed effect are redundant (Redundant Fixed Effects Tests: Cross-section F prob.=0.9556; Cross-section Chi-square prob=0.8573) and were not included in our pool estimation.

Liquidity is significant and has a negative impact on all interest rates future variations. Word1 and Word2 remain important in forecasting interest rate changes.

Table no. 11 – Future 9-month changes in spot Shibor and Treasury interest rate (Rt+9m - Rt+1), PBC's communications, liquidity stock and known macroeconomic variable sets

Dependent variables	const		Regressors $ annual appreciation (log)		$INFL_{t-1month}$		
	-29.748***(5.004)		4.198***(0.549)		0.233***(0.025)		
	$(LOAN/GDP)_{t-1quarter}$		$Leading\_Indicator_{t-1nonth}$		$GM1_{t-1month}$		
	0.021***(0.002)		0.248***(0.050)		0.031***(0.004)		
Shibor	r_{t+1}		$Word1_t$		$Word2_t$		**Liquidity2/1000**
ON	-1.080***	(0.137)	0.759***	(0.158)	0.380***	(0.044)	-7.153*** (0.907)
1W	-0.332**	(0.166)	0.498***	(0.171)	0.293***	(0.049)	-6.240*** (0.883)
2W	-0.651***	(0.128)	0.836***	(0.170)	0.374***	(0.047)	-8.250*** (0.876)
1M	-0.531***	(0.180)	0.730***	(0.278)	0.358***	(0.048)	-7.195*** (0.932)
3M	-0.507***	(0.141)	1.045***	(0.293)	0.402***	(0.057)	-7.156*** (0.906)
6M	-0.479***	(0.138)	1.042***	(0.301)	0.368***	(0.066)	-6.220*** (0.888)
9M	-0.472***	(0.126)	1.153***	(0.283)	0.371***	(0.066)	-5.763*** (0.868)
1Y	-0.457***	(0.127)	1.156***	(0.294)	0.372***	(0.071)	-5.415*** (0.864)
Treasury	r_{t+1}		$Word1_t$		$Word2_t$		**Liquidity2/1000**
3M	-0.771***	(0.137)	1.119***	(0.181)	0.524***	(0.044)	-5.382*** (0.878)
6M	-0.741***	(0.145)	1.131***	(0.210)	0.551***	(0.043)	-4.799*** (0.884)
1Y	-0.684***	(0.140)	1.157***	(0.221)	0.555***	(0.042)	-3.144*** (0.997)
3Y	-0.482***	(0.159)	1.052***	(0.319)	0.499***	(0.066)	-2.805** (1.112)
5Y	-0.319**	(0.137)	0.863***	(0.327)	0.452***	(0.074)	-2.312** (1.146)
7Y	-0.217*	(0.126)	0.608*	(0.331)	0.367***	(0.085)	-2.352** (1.148)
10Y	-0.161***	(0.134)	0.439	(0.348)	0.295***	(0.093)	-2.984** (1.213)
30Y	-0.093	(0.089)	0.457	(0.296)	0.255***	(0.093)	-5.382*** (0.878)
Adjusted R2	0.626						

Method: Pooled Least Squares; Period SUR (PCSE) standard errors & covariance (d.f. corrected); Sample (adjusted): 8/05/2015 - 11/02/2022; Included observations: 20 after adjustments; Cross-sections included: 16; Total pool (unbalanced) observations=320; */**/*** = significant at 10%, 5%, 1% of probability respectively; parameter SE in brackets

Liquidity and the ratio Loan/GDP should be relevant, also, in explaining future credit (loans) growth. Unfortunately, loans in China are measured only quarterly and the corresponding dataset is made of a few observations: it is, therefore, difficult to discriminate between alternative equation forms and to give a realistic valuation of coefficient significance.

We considered two different equations both estimated on the days when PBC's quarterly reports are published. In the first model (Table no. 12), the dependent variable was the future annual logarithmic change in loans, while the explanatory variables were: Loan/GDP, liquidity (in the form of liquidity2/Loans), and Word1 and Word2. The result is the credit increases when liquidity is high and news given by the central bank is of an expansionary type.

In the second model (Table no. 13), the dependent variable is the future annual logarithmic change in the ratio Loan/GDP, and the explanatory variables include, instead of Word1 and Word2, the 1-year Shibor and the spread between the 1-year prime rate and 1-year Shibor. Again, the amount of liquidity exerts upward pressure on the increase of credit (loans), while the two interest rates exert downward pressure.

Table no. 12 – Annual logarithmic change in loans one year later

Variable	Coefficient	Std. Error
constant	0.518***	(0.050)
Loan/GDP	-2.111***	(0.253)
Liquidity2/GDP	72.380***	(17.772)
WORD1/100	1.447**	(0.706)
WORD2/100	1.783***	(0.479)
Adjusted R-squared	0.733	
Included observations:	26	

Method: Least Squares; Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors; 1/01/2014 31/12/2022 only BPC's report days; */**/*** = significant at 10%, 5%, 1% of probability respectively; parameter SE in brackets

Table no. 13 – Annual logarithmic change in the ratio loans/GDP one year later

Variable	Coefficient	Std. Error
constant	8.220***	(1.090)
Ln(Loan/GDP)	-1.502***	(0.196)
Liquidity2/GDP	194.611***	(57.283)
1y-Shibor	-5.329***	(1.621)
1y-prime rate minus 1y-Shibor	-3.706***	(1.132)
Adjusted R-squared	0.647	
Included observations:	27	

Method: Least Squares; Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors; 1/01/2014 31/12/2022 only BPC's report days; */**/*** = significant at 10%, 5%, 1% of probability respectively; parameter SE in brackets

These two tables show that both equations, even if based on different models, consistently suggest that the amount of liquidity has a positive effect on the future growth in loans.

8. RESULTS AND DISCUSSIONS

This research paper showed how to quantify Chinese Central Bank communications. More precisely, it considers the content of the Bank's reports from 2015 to 2022, observing the role of the Central Bank for promoting economic growth, monetary policy and influencing interest rates and credit.

The level of policy interest rates decided by PBC are mostly independent of the actual levels of market interest rates of the same maturity (for both interbank and treasury returns). But, in the case of Central Bank Bills in Hong Kong operations (CBBHK1 and CBBHK2), PBC interest rates values remain consistent with their correspondent market returns of the same maturity.

A significant piece of information given in most monetary policy news items is the amount (in billions of RMB), and the term (i.e. the maturity) of each operation, also corresponding to liquidity creation. As was reported in Figure no. 1, a double 30 day moving average of the daily amount supplied by PBC with a jump in the amount in 2019 is apparent. A daily measure of the stock of total liquidity was obtained under the naïve hypothesis that liquidity is created on the announcement day and lasts according to the terms indicated by the Bank itself.

Several communication indexes from the Central Bank of China reports were constructed and used in the empirical analysis of this paper. The findings show that the Bank keeps in-step with the information from the reports. Its reports also continue to influence the country's monetary policy. These communications have a strong impact on the interbank Chinese money market, influencing credit growth as well.

An important aspect of this research is the attention concerning the methodology used to derive quantitative texts from the qualitative texts found in the reports of the Chinese Central Bank. When analysing the PBC's Reports, it was observed that most of its communications concern the real sector of the Chinese economy, and just a few concern price stability.

It is possible to measure the communication tones, and we evaluated two indices, Word1 and Word2: the higher their value, the more probable an increase in market interest rates. The strongest link between the future change in interest rates and communication is from 8 to 12-month future changes. The coefficient of Word1 is greater than that of Word2. Estimates are fairly stable and, even when macroeconomic variables are added to the regressors, Word1 and Word2 maintain their explanatory power. Even if, as we expected, inflation, annual dollar appreciation, leading indicator, M1 growth, and the ratio LOAN/GDP are positively related to future market interest rate changes, the explanatory power of Word1 and Word2 still remains relevant. It was also proved that the predictive power of implicit forward rates on future interest rates is very poor in China because the correlations between implicit forward rates and future Shibor rate variations are insignificant at 5%, both being under the one- and two-tail tests.

Also, liquidity created by PBC has a (negative) influence on future interest rates. It was also proved, through different models, that the amount of liquidity has a positive effect on the future growth in credit (loans).

9. CONCLUSIONS, LIMITATIONS AND IMPLICATIONS OF THIS RESEARCH

In conclusion, the Central Chinese Bank (PBC) works together with the Chinese State Council and the Ministry of Finance, and its monetary policy committee exists mainly as a consultative body. The main role of PBC is to keep stable economic growth. During the last years, PBC adjusted its monetary policy to influence interest rates, credit and to keep a stable rate of inflation and a stable financial market. It was observed that the content of Chinese Monetary Policy Communications clearly addresses the implementation of Chinese monetary policy, and that it plays an important role in creating the environment for sustained economic growth.

Monetary policy interventions have increased in recent years. The news items of PBC's monetary decisions (i.e. news involving operation interest rates and/or liquidity) started in 2018 and reached a steady horizontal trend in the second half of 2019. However, the interest rates of the operations are generally rather disconnected from the market rates that usually are in a corridor whose minimum is the *excess reserve interest rate* and its maximum is *1-year prime rate,* the interest rate on Standing Lending Facilities (SLF).

Even if this corridor is very ample and sometimes market interest rates move over to the maximum, we employed their mean value as a benchmark for market rate by using $r_t = R_t - (\textit{excess reserve interest}_t + \textit{1-year prime rate}_t)/2$ as a measure of the "height" of market rates.

When evaluating the PBC's communications (Monetary Policy Reports), we considered its statements as composed of economic variables (belonging to a different group) and their

qualifiers. We, therefore, assigned to the union between a variable and its qualifier a score from -1 for an expansionary monetary policy to +1 for a restrictive policy. The economic topics considered are: Y (real sector), M (money, credit), E (exchange rate and trade balance), W (the world economy), R (interest rates) and L (liquidity). To summarize the content of the PBC's documents we created two variables: Word1: the weighted average of the scores of Y, P, L, M, E, W, and Word2: the score of the topic R.

It was found that the scores (Word1 and Word2) of the various official PBC's communications are useful in predicting future variations of market rates, corresponding to different returns of Shibor and Treasury. The analysis was implemented by estimating their change as $R_{t+M(months)} - R_{t+1}$ in the following M-months of the day t when communications were published. A "Pooled Least Squares with cross-section specific coefficients" was employed.

The future variation of market interest rates is negatively related to their rt value, and when information released by PBC is mainly of a restrictive nature, an increase in market interest rates and a reduction in the amount of credit (loans) usually follows. In particular, this research has proved that the PBC's communications are especially relevant in predicting changes in interest rates variations of 8-12 months and that the coefficients of Word1 are greater than those of Word2. These characteristics are apparent when looking at Word1 and Word2 impulses on interest rates obtained by the so-called "local impulse estimation" of Jordà (2005).

For limitations of our research, it must be recognized, however, that our regression sample is made of only a few observations and results might not be that robust. We, therefore, checked for estimation anomalies and for residual autocorrelation, but no particular problem emerges.

An important result is that also for PBC is valid the statement of Trichet (1988), former president of the ECB, is also valid for PBC: "*communication is a constituent part of the institutional design for monetary policy*". But this opportunity is not yet exploited enough. In US and Eurozone, not only the Central bank communications help forecasting future interest rates: their information is incorporated in market expectations which influence the term-structure of interest rates strongly. The possibility for the Central Bank to move immediately market rates with maturity longer than one month is therefore still very low comparatively to Fed and ECB. Based on the main results of this research paper, it is proved that Chinese market interest rates and credit (loans) could potentially be strongly impacted by the PBC's Reports.

Another problem in China is that the policy rate corridor is very wide and its boundaries change only after long interval and are just of a few decimals. The result is that market rates react very slowly to them.

Since 2019, the Chinese Central Bank has introduced many operations to regulate liquidity. When including liquidity in the independent variable set in interest rate equations, this variable results significant with a negative coefficient.

An increase in liquidity is followed also by an increase credit (loan) growth.

Even these results emerge from our analysis, it must be recognized, however, that our regression sample is made of only a few observations and, therefore, results might not be that robust despite our econometric tests. Even if we checked for estimation anomalies and for residual autocorrelation, and no particular problems emerge, a good degree of caution is still useful.

Apart from this, many questions remain to be investigated. Is any other PBC's release more important than the one we examined? Which is the best method to classify the documents (on this purpose a comparison could be very useful)? Also, a comparison between a monetary reaction function and PBC's document contents should be very useful. A special research should also be directed to study why PBC's releases have just a small impact on the term-structure of interest rates. In particular, was there some improvement in the course of last years? Are communications useful also in predicting policy rates?

PBC, by releasing appropriate information and controlling liquidity could, therefore, have a significant influence on the path of future interest rates and credit.

Based on the main results of this research paper, it is proved that Chinese credit (loans) are impacted by the PBC's Reports and liquidity.

References

Bennani, H. (2019). Does People's Bank of China communication matter? Evidence from stock market reaction. *Emerging Markets Review, 40*, 1-18. http://dx.doi.org/10.1016/j.ememar.2019.05.002

CEIC. (2023). China Bank Lending Rate, 1988 - 2020 Retrieved from https://www.ceicdata.com/en/indicator/china/bank-lending-rate

Chang, C., Fang, L., Hong, M., & Ho, K. C. (2021). B., Ho, K-C. (2021). Impacts of monetary instruments on overnight spread under the interest rate corridor framework: Evidence from China. *Business Process Management Journal, 27*(6), 1822-1835. http://dx.doi.org/10.1108/BPMJ-12-2020-0537

China Foreign Exchange Trade System. (2023). Shibor. *Benchmarks.* Retrieved from https://www.chinamoney.com.cn/english/bmkshb/

Cour-Thimann, P., & Jung, A. (2021). Interest-rate setting and communication at the ECB in its first twenty years. *European Journal of Political Economy, 70*, 102039. http://dx.doi.org/10.1016/j.ejpoleco.2021.102039

Das, S., & Song, W. (2022). Monetary Policy Transmission and Policy Coordination in China. *IMF Working Paper*.

Fratzscher, M. (2008). Communication and exchange rate policy. *Journal of Macroeconomics, 30*(4), 1651-1672. http://dx.doi.org/10.1016/j.jmacro.2008.07.002

Funke, M., & Tsang, A. (2020). The People's bank of China's response to the coronavirus pandemic: A quantitative assessment. *Economic Modelling, 93*, 465-473. http://dx.doi.org/10.1016/j.econmod.2020.08.018

Gang, Y. (2021). China's Interest Rate System and Market-Based Reform of Interest Rate. *Journal of Financial Research, 495*(9), 1-11.

Garcia-Herrero, A., & Girardin, E. (2013). China's Monetary Policy Communication: Money Markets not only Listen, They also Understand, Working Papers 022013, Hong Kong Institute for Monetary Research Gerlac, S. (2007). Interest Rate Setting by the ECB, 1999-2006: Words and Deeds. *International Journal of Central Banking, 3*(3), 1-46.

Gerlac, S. (2007). Interest Rate Setting by the ECB, 1999-2006: Words and Deeds. *International Journal of Central Banking, 3*(3), 1-46.

Isaeva, E. A., & Leshchenko, J. G. (2019). Evaluation of the effectiveness of modern models of regulation of financial markets. *Креативная экономика, 13*(10), 2045-2066. http://dx.doi.org/10.18334/ce.13.10.40967

Jones, B., & Bowman, J. (2019). China's evolving monetary policy framework in international context. *Reserve Bank of Australia*.

Jordà, O. (2005). Estimation and Inference of Impulse Responses by Local Projections. *The American Economic Review, 95*(1), 161-182. http://dx.doi.org/10.1257/0002828053828518

Liu, J., Liu, L., Min, M., Tan, S., & Zhao, F. (2022). Can central bank communication effectively guide the monetary policy expectation of the public? *China Economic Review, 75*(101833). http://dx.doi.org/10.1016/j.chieco.2022.101833

Loughran, T., & McDonald, B. (2011). When is a liability not a liability? Textual analysis, dictionaries, and 10Ks. *The Journal of Finance, 66*(1), 35-65. http://dx.doi.org/10.1111/j.1540-6261.2010.01625.x

McMahon, M., Schipke, M. A., & Li, X. (2018). China's monetary policy communication: Frameworks, impact, and recommendations. *IMF Working Paper*.

PBC. (2015). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2016). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2017). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2018a). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2018b). Purposes and Functions. Retrieved from http://www.pbc.gov.cn/en/3688066/3688080/index.html

PBC. (2019). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2020). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2021). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2022). China Monetary Policy Report. Retrieved from http://www.pbc.gov.cn/

PBC. (2023). China Government Bond Yield Curve. *Announcement on Open Market Operations, 64*.

Picault, M., & Renault, T. (2017). Words are not all created equal: A new measure of ECB communication. *Journal of International Money and Finance, 79*(C), 136-156. http://dx.doi.org/10.1016/j.jimonfin.2017.09.005

Rosa, C. (2009). Forecasting the Direction of Policy Rate Changes: The Importance of ECB Words. *Economic Notes, 38*(1-2), 39-66. http://dx.doi.org/10.1111/j.1468-0300.2009.00209.x

Su, S., Ahmad, A. H., & Wood, J. (2020). How effective is central bank communication in emerging economies? An empirical analysis of the chinese money markets responses to the people's bank of China's policy communications. *Review of Quantitative Finance and Accounting, 54*(4), 1195-1219. http://dx.doi.org/10.1007/s11156-019-00822-7

Sun, R. (2020). Monetary policy announcements and market interest rates' response: Evidence from China. *Journal of Banking & Finance, 113*, 105766. http://dx.doi.org/10.1016/j.jbankfin.2020.105766

World Bank. (2020). China Economic Update - July 2020. Retrieved from https://www.worldbank.org/en/country/china/publication/china-economic-update-july-2020

Xu, W. (2019). The Connotation and Channel of the Central Bank's Monetary Policy Communication in the Post-crisis Era and Its Implications for China. *Proceedings of the 3rd International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2019)*. http://dx.doi.org/10.2991/iccese-19.2019.400

Yao, K. (2020). Exclusive: China's central bank to step up easing, won't borrow Fed playbook - sources. *Reuters.* Retrieved from https://www.reuters.com/article/us-health-coronavirus-china-pboc-exclusi/exclusive-chinas-central-bank-to-step-up-easing-wont-borrow-fed-playbook-sources-idINKBN21Q0JO/

ANNEXES

Table no. A1 – Comparison between China, US and Eurozone capacity of implicit forward rate in forecasting interest rate changes: correlations between $(6R_{6,t}-3R_{3,t})/3-R_{3,t}$ and $R_{3,t+3month}- R_{3,t}$

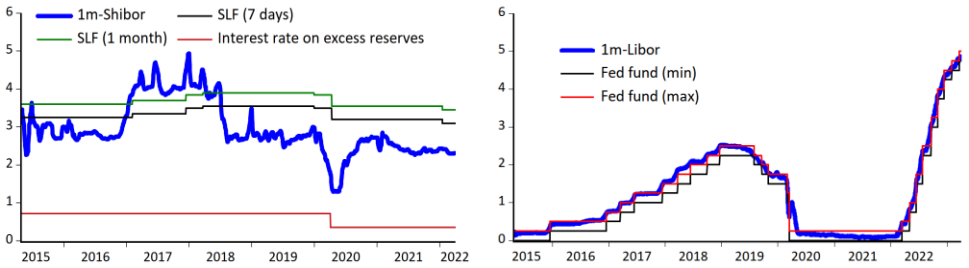
China	US	Eurozone
0.043	0.755	0.871

Note: Interbank interest rates, period 2015-2022 (daily data)

Table no. A2 – Interest rate corridor decided by BOC, Fed and ECB

	BOC			Fed	ECB	
	O/N	Official/actual	1m	Official/actual	official	actual
mean	2.54	0.25	3.08	0.25	0.69	0.44
max	3.00	0.25	3.50	0.25	0.75	0.50
min	2.28	0.25	2.88	0.25	0.50	0.25

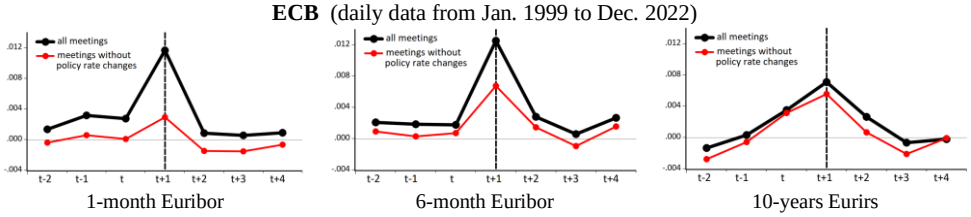
Note: period 2015-2022 (daily data)



China USA

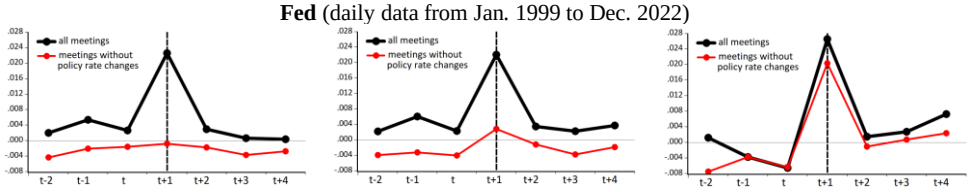
Figure no. A1 – Policy rate corridors and the 1-month interbank rates in China and USA

ECB (daily data from Jan. 1999 to Dec. 2022)



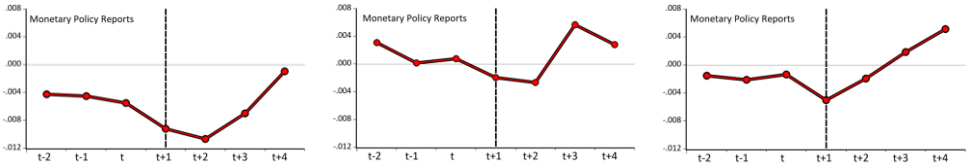
1-month Euribor 6-month Euribor 10-years Eurirs

Fed (daily data from Jan. 1999 to Dec. 2022)



1-month $ Libor 6-month $ Libor 10-years $ Irs

China (daily data from Jan. 2005 to Dec. 2022)



1-month Shibor 6-month Shibor 10-years Treasury

Day t = communication day, day t+1 = day after when communication content is known; period 2019 2012. Daily data for ECB and Fed: 2005-2012, daily data, for PBC.

Figure no. A2 – Market interest rate volatility (mean of absolute values of market interest rates) before and after official communications

In ECB and Fed case, the farther the maturity, the nearer is market reaction to communications with and without official rate changes. In China, market rate volatility does not have a clear pattern around the communication days. In particular, no increase in volatility turns out on the day after the publications of PBC Reports.

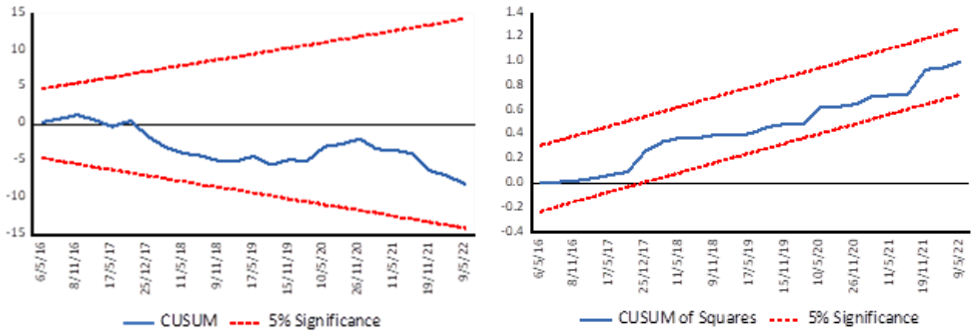


Figure no. A3 - Stability test for 1-month Shibor interest rates (9-months variations): CUSUM and CUSUM of squares

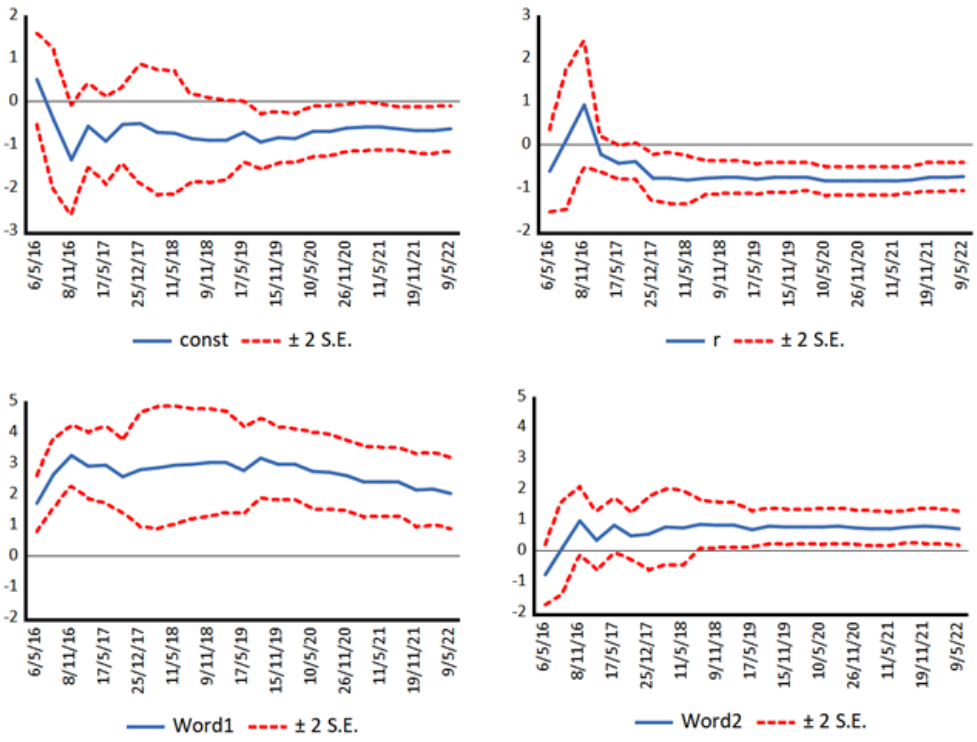


Figure no. A4 – Coefficients for 1-month Shibor interest rates (9-months variations): recursive parameter estimations of table 10

Table A3 - Correlation between implicit forward rate and correspondent future actual Shibor rate changes

	$(12\times R12m_{t+1day} - 6\times R6m_{t+1day})/6 - R1m_{t+1day}$	**$(6\times R6m_{t+1day} - 3\times 3m_{t+1day})/3 - R1m_{t+1day}$**	**$(12\times R12m_{t+1day} - 6\times R6m_{t+1day})/6 - R6m_{t+1day}$**	**$(6\times R6m_{t+1day} - 3\times 3m_{t+1day})/3 - R3m_{t+1day}$**
Mean of R1m between t+6 and t+12 months – $R1m_{t+1day}$	0.103	-	-	-
$R6m_{t+6months} - R6m_{t+1day}$	-	-	0.130	-
Mean of R1m between t+3 and t+6 months – $R1m_{t+1day}$	-	0.096	-	-
$R6m_{t+6months} - R3m_{t+1day}$	-	-	-	0.027

Note: Period 2016-2012 only days of official communications (Report)

Table no. A4 – Estimation of the mean of R1m between t+6 and t+12 months – $R1m_{t+1day}$

Variable	**Coefficient**	**Std. Error**
Const	-0.094	(0.243)
$(12\times R12m_{t+1day} - 6\times R6m_{t+1day})/6 - R1m_{t+1day}$	-0.553**	(0.206)
r_{t+1}	-0.850***	(0.169)
$Word1_t$	1.676***	(0.510)
$Word2_t$	0.618***	(0.202)
Adjusted R-squared	0.598	

Method: Least Squares; Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance; Sample (adjusted): 8/05/2015 10/08/2022; Included observations: 30 after adjustments: */**/*** = significant at 10%, 5%, 1% of probability respectively.